



WORLD CUP TECHNOLOGY

Football fans always get excited at World Cup time, but new technologies promise to raise passions in the 2006 tournament to fever pitch, as **Seth Barton** explains

The game of football is a simple one, with 22 players, two goals and one ball being the key ingredients. So the football pitch is the last place you'd associate with computer technology. However, at this summer's FIFA World Cup 2006 tournament, cutting-edge technologies will be used on a massive scale. The newspaper headlines will be all about the players, the fans and the scores; the human side of the game. But behind the scenes, computer technology will be involved in every aspect of this massive football extravaganza. In particular, this World Cup sees a mass consumer roll-out of two technologies that have been touted for the past couple of years: radio frequency identification (RFID) and high-definition TV (HD TV).

JUST THE TICKET

World Cup organisers desperately needed a way of keeping control of tickets for this event. To do this, they turned to the internet and tiny computer chips that can transmit information. To give you an idea of how big interest is in this, remember that the 2006 World Cup competition

started back in September 2003, when South American teams played their first qualifying games. Since then, 195 competing national sides have played a total of 847 matches, or roughly 77,000 minutes of football, to decide the 32 competing finalists (except for Germany, who qualify automatically as the hosts).

The finals are the pinnacle of a three-year-long football marathon. England is the only nation from the British Isles represented in the 2006 finals. However, they are probably the most talented England World Cup squad in many years and are expected to do well in the competition.

The quality of the England team, the huge hype surrounding this global event and affordable transport from the UK to the host country has motivated many people here to try to get tickets for the finals. Unfortunately, the number of tickets available to watch the matches is tiny compared to the number of people who want to attend, and such an imbalance is bound to cause problems.

The organisers had to come up with a ticketing system that would fairly distribute the

available 2.93 million tickets to fans all across the world. Internet sales were an obvious choice, so all publicly available tickets were made available online. You filled in an application form on your PC for the games you wanted to see, submitted it to the FIFA World Cup website, then sat back and crossed your fingers.

However, the odds were definitely against you. For starters, the German Football Association has the largest membership of any sporting organisation in the world. Everyone involved with football in Germany is a member of this gargantuan organisation, be they superstars, Sunday league players, officials or fans. Its total membership is 6.3 million people, which is approaching the population of Greater London. So even if they were the only people interested in attending the tournament, members would have only a 50/50 chance of getting one ticket to one game.

Tickets have been distributed to applicants by a series of lotteries, each one conducted under strict guidelines and scrutiny to ensure absolute fairness. However, concerns about the forgery of tickets and black market sales were



running high. So the organisers, FIFA and the German FA, decided to embed a small electronic chip in every single one of the 2.93 million tickets.

IDENTITY PARADE

The World Cup tickets will contain radio frequency identification (RFID) tags. The tag is a small silicon chip that stores and processes data, along with an antenna, which can receive and broadcast radio frequency signals. The whole thing is as thin as a sheet of paper and about the size of a postage stamp. Philips is manufacturing the tags for the World Cup tickets at an estimated cost of 10 eurocents (around 6p) per chip, which is barely significant considering the €35 (around £24) price for the cheapest seats at the group-stage matches.

RFID technology has been around for a while now, with uses including tracking shipments, payment cards, smart keys for cars, and even implantation under the skin of livestock and pets for identification purposes. One nightclub in Barcelona even offers its VIP clientele the option of under-the-skin RFID tagging to provide streamlined access to the club and the ability to pay for drinks without cash. This is very useful if your *haute couture* outfit doesn't come with pockets.

It's all gone quiet over there Audio at the World Cup

Audio is a crucial element of covering a football match, especially if you're a radio broadcaster. There will be 16 directional microphones arranged around the pitch in each stadium to pick up sound from the game itself, while crowd noise will mainly be picked up from four spatial microphones in the corners of the stadium. The audio from these microphones is processed to provide high-quality digital audio to accompany the video feeds.

The main feeds will include stereo sound that accompanies the changing camera angles of the basic feed, featuring a mix of crowd noise and on-pitch audio such as ball kicks. It will include sounds from incidental camera coverage, such as steadicams, pitch-level cameras and tunnel coverage.

The standard sound mix lacks any kind of commentary, as individual broadcasters will add their own commentary as appropriate. A radio version is also available with more consistent audio levels, without the changes that reflect varying camera angles. This provides a background ambience for radio broadcasters worldwide to comment over.

A multi-channel 5.1 sound mix will be made available to broadcasters via Dolby E, but don't go checking your surround-sound amplifier for compatibility, as you're bound to be disappointed. This is because Dolby E is

a system devised to make surround-sound information compatible with the traditional stereo wiring used by TV studios.

Dolby E was developed to solve several problems that made standard Dolby Digital (DD) less than ideal for broadcasters. For starters, the individual frames of DD audio are not the same length as video frames and, because DD is a compressed audio format, cutting an audio frame in half can result in clicks and pops when it's decoded by your surround-sound amplifier. The compression of DD audio causes problems for programme makers, as it isn't designed to be repeatedly encoded and decoded in editing, with audio quality quickly degrading.

Dolby E solves both these problems with audio frame rates that match video timings, and the capability to go through 10 encoding and decoding cycles without degradation. It has become the standard for surround sound in TV broadcast and production facilities.

The Dolby E signal will be decoded and broadcast in the UK as stereo with encoded surround information, as Freeview in this country doesn't support full 5.1 Dolby Digital. If you have a surround-sound amp that deals with Dolby Pro Logic I or II, you'll hear the benefit, with pitch noises coming mainly from the front speakers, while crowd noises are more prominent from the rear.

The RFID tags used for the World Cup are passive, so they don't require a built-in battery. Instead, the tag receives an incoming radio signal, which gives sufficient power for the chip to process the incoming signal. The antenna uses a process called backscattering, using the incoming signals' own power to send back a reply. This allows two-way communications between the actively powered reader and the passive tag.

All 12 World Cup stadiums in Germany have been fitted with RFID readers at their many entrances. Ticket holders passing through the turnstiles just have to hold their ticket near the reader, which will communicate with the tag, and if everything checks out, the turnstile will allow access.

The information on the RFID tag is minimal. It identifies the ticket and refers the reader to a central computer system, which holds a database of information for authentication. The data on that database has been compiled from the lengthy application forms that people filled in online to acquire the tickets originally. These forms included fields for name, address, credit card details, passport number and team supported.

All this means that tickets do not have to be checked by hand and forgeries are practically

impossible. Tickets can be checked by officials to ensure that the ticket holder is the original purchaser, helping to prevent black market trading of tickets at massively inflated prices. With this in mind, ticket holders have been instructed to bring photo ID with them to all games. How effective this will be remains to be seen, though it's undoubtedly the biggest use of RFID for event ticketing, and the systems will remain in place at the stadiums for continued use after the finals have finished.

PROTECTION RACKET

Questions have been raised by German civil rights groups about whether the massive database of ticket holder details is necessary. As it's linked directly to the traceable tags, it could be a powerful tool for tracking individuals within or even around the stadiums. The organisers have given reassurances, however, that the only scanners used will have a range of about 20cm and no mass tracking of ticket holders will occur, even for policing purposes. The issue is currently under consideration by the German Data Protection Authorities and Ministry of the Interior.

If RFID is hailed as a success at the World Cup, it will be another step towards its acceptance in many diverse aspects of our lives.



◀ A radio frequency identification tag will be embedded into each ticket sold for the World Cup



Auntie goes to Germany The BBC's coverage plans

We talked to the BBC about its coverage of the World Cup. Louisa Fyans, the BBC's head of publicity for sport, answered our questions.

Computer Shopper: How many hours of coverage will the BBC be showing for the World Cup?

Louisa Fyans: In excess of 100 hours, including live games, nightly highlights, Football Focus, Interactive, children's BBC, news and so on. Radio is in addition to this.

CS: Are there any new technologies being used to cover this World Cup that weren't used for the last one?

LF: This will be the first tournament available to the viewing public in HD and widescreen.

CS: How many outside broadcast units is the BBC sending to the World Cup?

LF: One main OB (outside broadcast) unit to cover the 'big' games and a couple of smaller

single-camera uplink units, covering the England camp for example.

CS: How many staff is the BBC sending to the World Cup?

LF: We've applied for 300 press accreditations. These will cover sport television production, BBC interactive, Radio Five Live (transmitting every game live throughout the World Cup), online and BBC News. We are the only UK broadcaster to provide this kind of TV, radio and online coverage of the tournament.

CS: Does the BBC edit and mix its own coverage of the games or use the standard TV feed from the stadium?

LF: When we're at the venue presenting a game, we'll have a few of our own cameras to personalise coverage; I have the ability to cut in a shot of David Beckham should the commentator start talking about him. In the main, and when we are not onsite, we will take the host coverage as per our contract.

Eventually, everything could contain an RFID tag, be it the groceries you buy from the supermarket, prescription medicines from your doctor, credit cards, passport or driving licence, and even the cash in your wallet. This would allow a more direct relationship between the movements of physical objects and the corresponding data on the internet. Whether this becomes an invaluable tool for greater efficiency or an unwanted intrusion into our privacy is yet to be seen.

BROADCAST NEWS

Presuming you weren't lucky enough to get a ticket, you'll have to enjoy the finals from the UK. TV has been the best way of doing this for around 40 years now, and on the surface the format has changed little. However, the technology that brings those pictures into your living room has been continuously progressing.

The 1966 World Cup final was broadcast in black and white to an estimated audience of 32.3 million people in the UK alone, according to research done recently by the British Film Institute. This was an incredibly large audience, considering the fact that fewer than 15 million households actually had television sets at that time.

In 1970, we saw the first worldwide broadcast of a World Cup final. It was Brazil's third tournament victory and the TV coverage undoubtedly added to Brazil's – and particularly Pele's – already massive reputations. All this was thanks to Telstar, the first active communications satellite. The 1970 tournament also brought us colour pictures for the first time, which was particularly useful given the simultaneous introduction of the yellow and red card system for fouls.

The 2002 finals, played in Japan and South Korea, included 25 match days and drew an estimated combined global audience of 1.5 billion viewers, almost a quarter of the whole world's population. This was despite time differences that forced traditional football

audiences from Europe, Africa and South America to watch their respective teams at the crack of dawn.

TV coverage of the 2006 finals will be changed by the popularity of two new technologies. First, most of us now receive our TV signal in digital form and use a set-top box to decode it. This completes the digital chain in TV broadcasts, from the camera, through the editing process, into our homes. Second is the mass adoption of widescreen TVs, largely driven by the popularity of DVD movies. For the first time, we will be enjoying games in widescreen, letting us see more of the play than ever before.

Providing the slick high-tech coverage that the modern TV viewer expects is a huge job, especially as all the broadcasters around the world must fulfil the specific needs of their particular audiences. This task is overseen by Host Broadcasting Services (HBS), which was set up in 1999 specifically to produce TV and radio coverage of the 2002 and 2006 finals.

In each of the 12 stadiums, there will be a minimum of 20 digital high-definition (HD) cameras. These cover the game from every angle, with multiple cameras providing close-ups and alternative views of the action. Specialist cameras are also fitted in the goalmouths for replays. There are even dedicated cameras covering the two team benches.

CAMERA ANGLES

The cameras themselves have specifications home digital video enthusiasts can only dream of. HBS will use Thomson LDK 6000 cameras, each of which has three 9.2 million pixel CCDs with which to capture every possible detail that comes through the lens. Compare this with the mere 800,000 pixel CCDs in a standard video camera to get some idea of the quality of the images being captured.

The cameras output HD video in the 1080i and 720p format (more on this shortly) at up to

60 frames per second, and can simultaneously provide standard-definition TV as well. The camera body weighs a remarkably light 4.3kg, so it can be easily mounted on a boom for tracking shots from behind the goals, or used by a steadycam operator for close-up shots.

Plenty more work is required to turn those 20 digital image streams from the stadium into broadcast-quality TV coverage. The video captured by the cameras is used to generate a series of feeds that can be used by broadcasters across the world. It is these feeds that will mainly make up the coverage provided by the BBC and ITV in the UK.

The basic feed consists of a real-time edit of the best camera angles to cover the action. Additional feeds such as the extended stadium feed give longer coverage of the match by providing live coverage inside the stadium well before kick off. The Extended Basic International Feed (EBIF) show will include more than 500 specially produced features covering a range of connected topics such as the host cities, culture and festivals, team training, personalities, locker rooms, players and fans arriving and so on.

There are also supplemental and isolated feeds, so broadcasters can edit together their own coverage. The main supplemental feed is a continuously running highlights feed, which loops a selection of recent key incidents throughout the game and is constantly updated as the match progresses. There are also team and player feeds giving more concentrated coverage on a particular side and a specific player on that side. Finally, the isolated feeds give access to a small range of specific cameras, including the 'beauty shot' camera that gives a wide-angle view of the whole stadium interior.

All these feeds are then made available to broadcasters. These will often be based near the stadium itself in a broadcast compound, so they can run a feed from their own commentary box to mix with the feeds provided by HBS. In addition, there is the massive International Broadcast Centre (IBC) in Munich. The IBC takes up over 30,000 square metres of indoor space, as well as having a large satellite farm. This is where broadcasters from all over the world will coordinate and edit footage from the feeds before beaming it by satellite back to their respective audiences.



▲ The LDK 6000 camera has three 9.2 million pixel CCDs



FIFA on your phone Mobile Matchcast in action

The Mobile Matchcast service will keep you informed with news, commentary and match reports. We spoke to Dirk Hensen at Yahoo! about working with FIFA to bring up-to-the-minute information to your mobile phone.

Computer Shopper: How much traffic is the official World Cup site likely to receive?

Dirk Hensen: The Yahoo! FIFA site (<http://fifaworldcup.yahoo.com>) had two billion page views and 20 million unique users in 2002, and we expect the number of users to grow significantly in 2006.

CS: How does Mobile Matchcast work?

DH: It is a downloadable client application for mobile phones. It is free to download and use. The client is a Java MIDP 2.0 application offering a rich graphical user experience, real-time match data and the ability to share the application with friends. It will serve as a live ticker during the World Cup, with each match delivered as a feed to the user's phone.

CS: What information is available from Mobile Matchcast?

DH: The live feed area is the heart of the application. When matches are in session, users will go to this section for a live match ticker, giving scores and match time elapsed. They can also see a graphical match summary, with each team's relative stats such as goals, shots, corners, fouls and percentage of possession displayed. There's also a game log of important events, commentary, team information and photos.

The live match data is archived as the World Cup progresses so users, no matter at which point they start using the client, can always access previous match data. In addition, the Matchcast Client will offer news from the tournament, a schedule of upcoming games and team

standings. All this is accessible on a team-by-team basis.

CS: Will all the games be covered this way?

DH: All 64 matches will be covered with Mobile Matchcast.

CS: How many people are working to keep the website up to date?

DH: Currently on FIFA's side there are 20 editors in Zurich and around the world, four coordinators and producers, and 30-plus engineers from Yahoo!. During the World Cup, this will rise to 80-plus people in Berlin representing FIFA and Yahoo!, from 20 countries.

Visit <http://fifaworldcup.yahoo.com> and click Mobile for details.



▲ Get briefed on all the latest FIFA bulletins with Mobile Matchcast

HIGH HOPES

Digital TV production and broadcasting is all well and good, but to get the best coverage of the finals you will want to watch them in High Definition. Normal PAL TV signals in the UK use an interlaced 720x576 resolution signal, but the HD signal will be a far crisper 1,920x1,080 interlaced resolution, or 1080i as it's commonly known. The 720p standard (1,280x720 progressive) may have been a more suitable choice for such a fast-moving sport as football, as an interlaced picture can suffer from jagged edges on fast-moving objects such as a football. Despite this, the picture will still be a massive improvement over the aging, and interlaced, PAL signal.

Unfortunately, HD TV is still in its infancy in the UK, but if you're determined to get hooked up, we've compiled a handy summary of the potentially available services below. It's worth remembering that your local pub may get HD TV in time for the tournament, so you can watch the game in HD for the price of a pint or two.

If you want to receive high-definition coverage at home in the UK, your options are limited. All the games being covered by the BBC – roughly half of the total including the final – are being made available on its new HD channel. Unfortunately, with analogue and standard-resolution digital broadcasts filling the assigned TV frequencies, there's no space at present for a permanent terrestrial HD channel. This channel will be available to customers accessing HD on Sky TV and Telewest, as well as a small number of people participating in the BBC's technical trial.

"The trial will last up to 12 months and is a closed technical trial, which will be confined to a few hundred recruited volunteers in London," said Jackie Burdon, publicity manager for HD TV at the BBC. "The purpose of the trial is to test the technology and the capabilities of the platform, and also do some audience research. Trialists will be selected to represent the audience as far as possible. We will supply a set-top box, but they will have to have their own HD display." For further information on the trial, keep an eye on www.bbc.co.uk/digital.

Free HD coverage of the World Cup is likely to prove as popular as the match tickets were, so even if you live in London you'll want to consider some other options. Telewest will be offering the BBC HD channel through its cable TV service, but the service is available only in certain postcodes, so check www.telewest.co.uk to see if your area is covered.

Sky is also offering the BBC HD coverage, as well as a range of other programming in HD. You can receive this anywhere in the UK as long as you have a Sky satellite dish. Sky HD requires you to invest in a new set-top box, costing a hefty £300, plus you'll have to pay an additional monthly subscription fee of £10 on top of the usual Sky+ package. See www.sky.com/hd for more details.

WORLD IN MOTION

We were hoping to see whole matches live on our mobile phones, but this is still being negotiated in the UK. At the time of writing, we weren't able to get a firm answer from the major networks. T-Mobile's TV in Your Pocket service seemed to be closest to making it happen. For details of this, see www.t-mobile.co.uk.

It may be that a smaller firm called ROK has the best answer for now. ROK TV works on a fairly wide range of handsets, including Nokia smartphones and many of the popular Sony Ericsson models. This is because it uses a GPRS signal to carry the video to your phone. To receive TV, you must install the ROK media

player on your phone. You need to download the software to your computer and then use a Bluetooth connection or data cable to install it on your phone. This is fine if you have the kit to do this, but it's a pain for those who have never connected their mobile to their computer before.

Once installed, you set up an account with ROK, choosing the TV stations you want. Each channel costs 99p per month to subscribe to, or you can have the whole package of 13 channels for £9.99. However, the costs only begin there, as you have to pay your mobile provider for the TV video data that you receive from ROK, which amounts to around 1MB for four minutes of TV viewing. Data prices per megabyte vary depending on your network, from around 50p if bought in large bundles up to £3 for pay-as-you-go users. However, you may have free megabytes bundled with your contract and some providers are now offering unlimited usage packages.

If you want to watch full live matches, you'll also have to get your hands on ROK's Black Box. This is a set-top box that streams live TV to your mobile handset. It also uses a GPRS signal, and again you'll have to pay for the data. The box costs £250, though it will be available to rent for just £12 per month.

Apart from HD, there are other technologies being used for the first time to help you enjoy the tournament. One of these is the Mobile Matchcast service from Yahoo!, the official online sponsor of the finals; see the 'FIFA on your phone' box above for details.

POST-MATCH ANALYSIS

While football may remain a simple game, off the pitch the 2006 World Cup tournament will rely on a wide range of technologies, and that's without considering the many intricacies of the essential brewing and potato snack industries. Many of the technologies being used aren't brand new, but the event is a hugely important showcase for their continued growth and eventual mass acceptance. **CS**



▲ ROK's Black Box streams live TV to your mobile handset using a GPRS signal